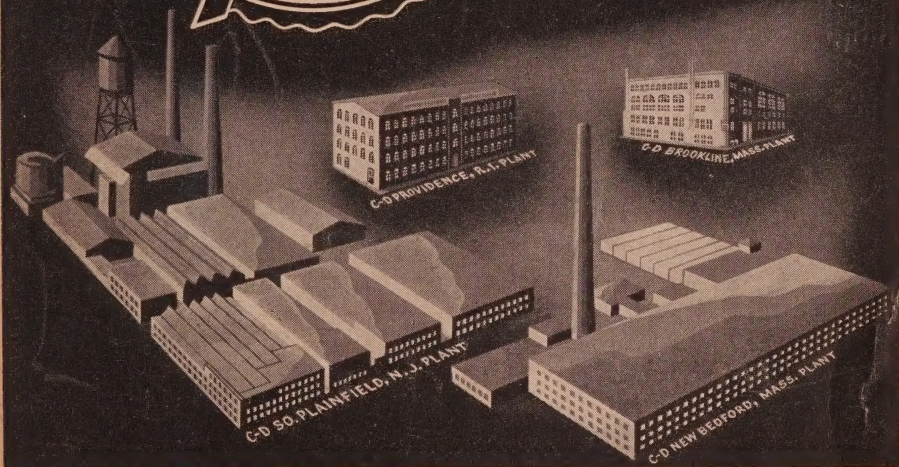


The CORNELL-DUBILIER **Capacitor**



Vol. 14

OCTOBER, 1949

No. 10

CORNELL-DUBILIER ELECTRIC CORP.
 Hamilton Boulevard, South Plainfield, N. J.

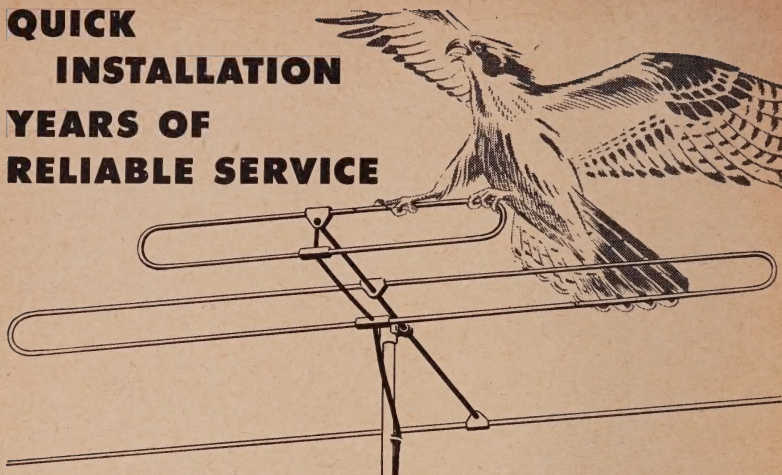
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SIMPLE SQUARE-WAVE GENERATORS

Square waves permit the rapid testing of the frequency response and general overall behavior of an audio-frequency amplifier or a. f. network. The principle involved is simple: a square wave, such as shown in Figure 1, is applied to the amplifier input terminals. The amplifier output voltage then is examined with an oscilloscope. If a square wave of the same configuration emerges from the amplifier, the frequency response is good and the phase shift negligible. If the



Fig. 1.

shape of the output wave departs from squareness, distortion is present within the amplifier under test. If the test

wave is known to be square in shape, there is no need to examine both input and output shapes.

A square-wave test of this sort is invaluable to the busy amplifier serviceman who does not have the time to make point-by-point frequency runs or who does not own a distortion meter or wave analyzer. The square-wave test appraises simultaneously the frequency response and phase shift of an amplifier throughout the audio range.

In order to understand how one or two low-frequency square wave signals may be used to check an amplifier at higher frequencies throughout the audio spectrum, it is necessary to recall that the steep-sided square wave is rich in harmonics and that each of these harmonic frequencies passes through the amplifier under test. A peculiarity of the square wave is that it contains only odd-numbered harmonics. Therefore, it may be neces-

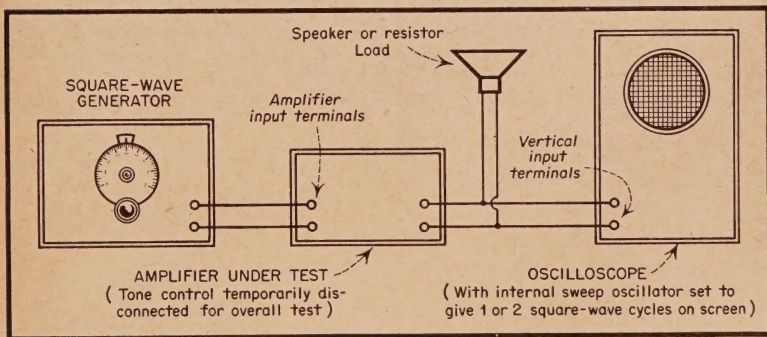


Fig. 2.

sary when making a square-wave test to employ two different fundamental frequencies in order that the harmonics will occur at certain desired test frequencies. However, a very low fundamental frequency, such as 60 cycles, produces such a multitude of odd-numbered harmonics lying close

together (120 cycles apart) that a square wave at such a frequency often will suffice as a single-frequency test signal.

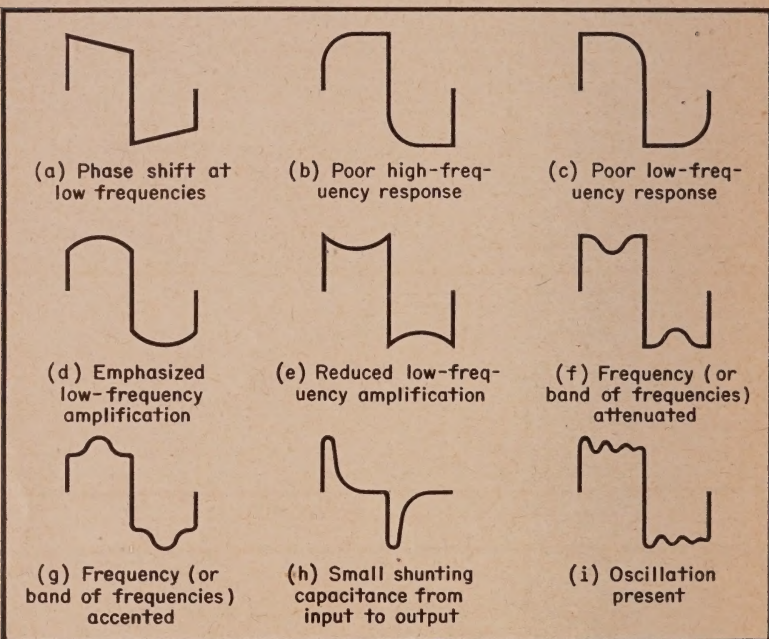


Fig. 3.

together (120 cycles apart) that a square wave at such a frequency often will suffice as a single-frequency test signal.

The simple apparatus setup for square-wave testing of an amplifier is shown in Figure 2. The same arrangement may be used for testing

of course, does not permit us to include a complete catalogue of possible patterns here.

Any statement regarding the usefulness of square waves naturally invites the question, "How are square waves obtained?" Several means are available. Several modern, factory-built

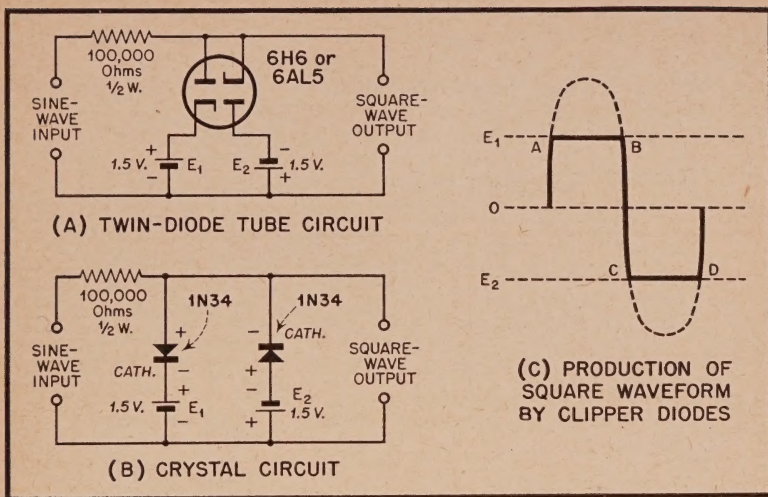


Fig. 4.

audio oscillators will give either sine-wave or square-wave output depending upon the position of a selector switch. One or two models of oscillators of this type are available at low prices.

Separate square wave generators also are available, but these are laboratory-type instruments and accordingly are high priced. A number of circuits are available for converting sine waves

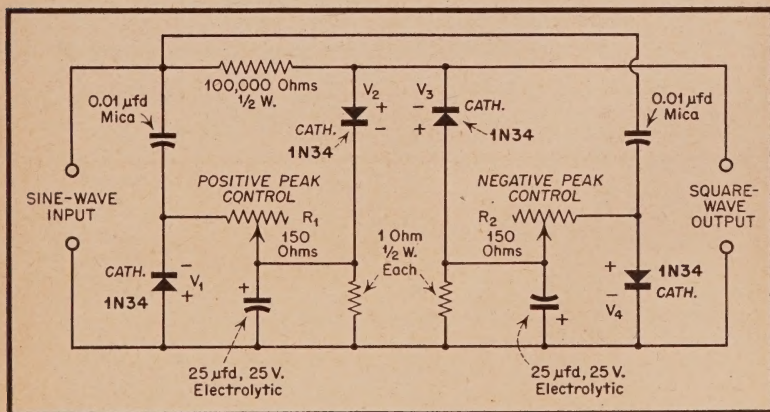


Fig. 5.

into square waves, and these are the basis of square-wave generators which may be constructed inexpensively by the serviceman or laboratorian. Several simple, practical circuits of this type are described in this article.

Twin-Diode Clipper

The simplest circuit for converting sine waves into square waves is the twin-diode limiter or "clipper." This circuit is shown in Figures 4(A) and 4(B). The clipper circuit may employ either a twin-diode tube of any type or a pair of 1N34 crystal diodes. Silicon crystals are not recommended for this application, since they are apt to be subjected to burnout voltages.

The diodes are connected "back-to-back" in the clipper circuit. One diode is biased positively and the other negatively by separate $1\frac{1}{2}$ -volt dry cells E_1 and E_2 , or by separate $1\frac{1}{2}$ -volt potentials obtained from a well-filtered power supply. In order to produce a square wave, this circuit clips the larger percentage of each positive and negative peak of the in-

coming sine-wave voltage, as shown in Figure 4(C). The positive peak of the sine-wave voltage thus cannot increase beyond the biasing voltage E_1 , nor can the negative peak increase beyond the biasing voltage E_2 . As a consequence, the positive and negative voltages level off to a constant flat-top value from A to B and from C to D (See Figure 4-C). As may be seen from Figure 4(C), the sides of the resultant pattern are not exactly vertical. They can be made very nearly so, however, by clipping at a low voltage with respect to the peak sine-wave voltages. This is the reason $1\frac{1}{2}$ -volt biasing potentials are employed. The sides then will be sufficiently steep to make the waveform square enough for most practical purposes. In the circuits given in Figures 4(A) and 4(B), best squareness will be secured when the sine-wave input signal is at least 20 volts r. m. s.

Figure 5 shows a variation of the crystal circuit in which two extra crystals, V_1 and V_4 , are employed instead of batteries to supply the d. c. bias voltages. These additional diodes are

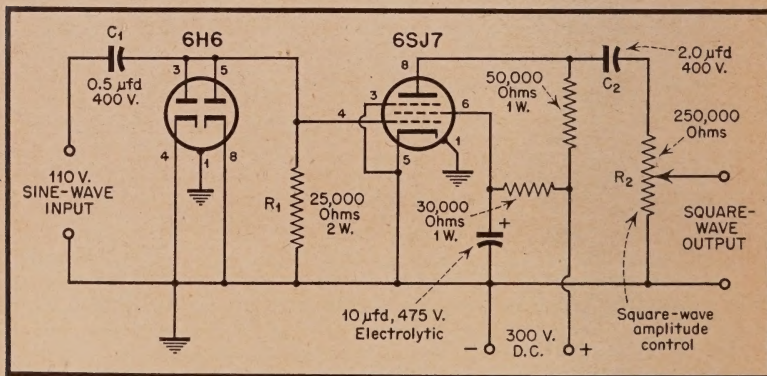


Fig. 6.

shunt-connected rectifiers which deliver adjustable bias voltages from the sine-wave input signal. The d. c. voltage in series with each clipper crystal (V_2 and V_3) is controlled in value by means of the potentiometers R_1 and R_2 . The d. c. voltage is developed across 1-ohm resistors in order that negligible resistance may be in series with the clipper diodes. The height and flatness of the top of the positive square wave peak is controlled by means of R_1 , while the height and flatness of the negative peak is controlled by means of R_2 . The square wave pattern may be viewed on an oscilloscope screen while the potentiometers are adjusted.

Diode-Pentode Blocking Circuit

Figure 6 shows a different type of circuit for obtaining square waves from sine waves. This arrangement is superior to the diode circuits previously described but does not have their simplicity, since it requires a 300-volt d. c. power supply for its operation. The arrangement shown in Figure 6 is intended for producing 60-cycle square waves from the power-line voltage. These waves will be satisfactory for the usual run of audio amplifier testing. For higher-frequency operation, capacitors C_1 and C_2 each should be reduced to 0.01 microfarad.

In this circuit, square waves are produced by blocking the grid of a zero-biased sharp-cutoff pentode. The shunt-connected 6H6 tube rectifies the incoming sine-wave voltage and produces large negative d. c. half-cycle pulses across resistor R_1 . These pulses are applied to the 6SJ7 control grid and they bias the pentode to cutoff during an appreciable part of each

negative half-cycle. The positive half-cycles are not transmitted by the 6H6. The cutoff periods result in a square-wave voltage across the 6SJ7 plate load resistor.

Amplitude of the square-wave output is adjustable by means of potentiometer R_2 .

Input Signal Source

The sine-wave input signal voltage required to operate the square-wave generators described in this article may be obtained from an audio oscillator or, when the frequency of 60 cycles is satisfactory, from the a. c. power line. Audio oscillators so used should have a substantial voltage output, at least 15 to 20 volts r. m. s. When this voltage level is not obtainable directly from an oscillator, an external audio amplifier having good waveform must be employed between the oscillator and square-wave generator.

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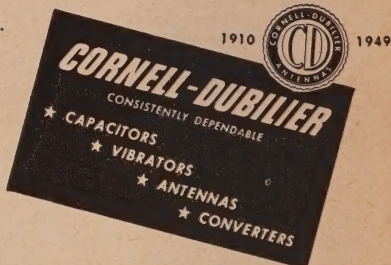
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12RU15	12	110 V 60 cycle	150		7 x 12 1/4 x 12 1/2	22	78.95	47.37
32R8	32	110 V 60 cycle	80	Farm and Marine	6 1/4 x 7 1/4 x 5 1/8	13 1/4	48.50	29.10
32RU15	32	110 V 60 cycle	150		6 3/4 x 12 3/4 x 7 1/2	22 1/4	73.50	44.10
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FOR SALE—Readrite model 432A radio tube tester, in very good condition, \$20. Newell T. Mery, Altmont, Ill.

WANTED—Coils for HRO-M, especially 14.0-30mc type JA. Would like all if possible. George W. Harold, 1907 S. Park Ave., Haddon Heights, N. J.

FOR SALE—Riders' vol. 4, in practically new condition. Best cash offer takes it. C. D. Hewitt, 60 Harmon St., Hamden 14, Conn.

FOR SALE—Meissner 3 tube regenerative receiver, 550kc to 15mc including long wave band and tubes, \$8.50. Otto Pollei, Jr., 118 N. Western Parkway, Louisville 12, Ky.

SELL OR TRADE—1947 NRI course; Heath-kit sig. gen.; several radio books. Want good tube tester and stock of tubes or what have you? Edward J. Hocking, 27 Sharon St., Boston 18, Mass.

TRADE—BC-603-604 push button 10 meter FM transmitter-receiver for mobile, with dynamotors. Want Riders' Manuals, movie camera or projector. Karl H. Stello, 925 Monroe St. N. E., Washington 17, D. C.

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WANTED—Ham transmitter, 100-200 watts, all bands, phone and C.W. Milton L. Chatkin 25 Auburn Rd., West Hartford 7, Conn.

WANTED—Triumph "3" scope. Please state price and condition. Robert Sodus, 2401 Tilghman St., Allentown, Pa.

TRADE—About 250 copies of Radio News, Radio Craft, QST, CQ, Radio Service Dealer, Radio Maintenance, Radio, dating from 1941 to present. All in good condition. Want television set or kit. Jess Chewning, 801 East Washington St., East Peoria, Ill.

FOR SALE—Complete National Schools Home Study Course, in A-1 condition. Write for details. J. F. Kent, 1916 Mulford Ave., New York City 61, N. Y.

SELL OR SWAP—Shure 51 microphone (list \$39.75) brand new in sealed carton, \$20, or what have you? R. Moore, 3963 1/2 Flower Dr., Los Angeles 37, Calif.

SELL OR SWAP—Riders' Manuals, 1 to 4, 5, and 6. Want modern tube checker, test equip., television components or front end, or portable typewriter. Harold F. Jones, 1010 Floral Ave., Schenectady 10, New York.

WANTED—10" or 12" television rec in perfect operating condition; good used test equip.; war surplus equip. used on VHF frequencies. Have for trade service equip., war surplus, ac-dc receivers, or will pay cash. Wood Radio & Electric Shop, 2036 Chalfant St., Wilkesburg, Pa.

FOR SALE—Radio Service neon sign. Red and blue letters, complete with transformer; 534 Hickok tube and set tester, all guaranteed in perfect condition, \$150 takes all. John W. White, Sterling Ave., Winona, Miss.

FOR SALE—New Army mine detector set, AN/PRS-1, complete with batteries, case and instructions. Shipped prepaid for \$37.50. George Holy, Jr., Box 34, Highlands, Texas.

FOR SALE—Supreme 589 tube tester, \$20; Supreme 599A set and tube tester, \$40; Silver 906 sig. gen., \$65; Meissner Analyst, \$65. Airway Television Service, 229 Jericho Turnpike, Floral Park, N. Y.

FOR SALE—Model 571 Supreme sig. gen. with variable 400 cycle audio output. This is a post war model, like new, complete, \$55. W. E. Young, Spirit Lake, Iowa.

FOR SALE—U. S. Army field phones, \$10 a pair; National NC 44, \$40. T. J. Tucci, 5228 Penway Ave., Philadelphia 24, Pa.

FOR SALE—Solar model CE Capacitor Exam-eter; RCA test oscillator, ac operated, model No. 167-B. Both only 3 years old, \$25 each. Russ Elenbaas, 2248 Horton Ave., S. E., Grand Rapids 7, Michigan.

WANTED—A junk chassis of a Philco 38-7, with tuning section and controls in working condition. Also a new recording of "Dream," on Decca or Capitol. Will pay three times the cost to get record. Richard Burch, 248 South 9th St., Lebanon, Pa.

WANTED—NRI Communications Course, lessons only. Also want books on radio communications. Send list and price on course and books. Daniel Seidler, 4355 So. Honore, Chicago 9, Ill.

FOR SALE—New Tele-tone television set, model 249, in original carton, \$150. (cost \$249). Will ship express insured. Bliss Waters, Oneida, Tenn.

FOR SALE—CREI Engineering Course, sections 1 and 2. Reasonable offer accepted. Milton W. Meriwether, 801 Thompson St., Elmira, N. Y.

WANTED—The following back issues of Radio News magazine: April, 1943; Dec., 1943; Feb., 1947; March, 1948; Aug., 1948. Leland I. Anderson, 127 Seymour Ave. S. E., Minneapolis 14, Minn.

FOR SALE—Ace 230V ac or dc tank vacuum cleaner, with attachments; Olds 8 deluxe twin speakers car radio. Both articles in perfect shape, \$15 each. E. E. Clayton, 245 Morris Ave., Springfield, New Jersey.

FOR SALE—Ohm-Volt-Millimeter, manufactured at Chicago. Best offer. Higgins Radio Service, Mineral, Arkansas.

FOR SALE—Heathkit 5' oscilloscope, just constructed, in good condition, used about 8 hrs., \$35. Or what have you? John Arrington, Barrett and Arrington Radio Serv., Hogsauville, Ga.

WANTED—6V power pack, sel. rect., for auto radio service. State price and particulars. William C. Carlson, 46 Palace Place, Port Chester, N. Y.

FOR SALE OR TRADE—Precision E-200-C sig. gen., used less than five hours, \$50. Or trade for late model Volt-ohmyst VTVM. Victor A. Inkildson, 1505 N. 39th St., Milwaukee, Wis.

FOR SALE—Everitt's "Fundamentals of Radio," \$2.50; UCP Radio Master Catalog, \$2.50; Western Electric relays, telephone type, coil 1280 ohms, 3P.S.T. contacts, \$0.40, 3 for \$1. All items FOB. Raymond H. Ives, Route 2, Lake Terrace, Norfolk, Va.,

FOR SALE—High quality Federal recorder. Two speed cuts up to size 13" blanks, complete with extra set of tubes and three sapphire cutting stylus, in excellent condition, \$265. E. T. Graham, 179 Larch Ave., Bogota, N. J.

SWAP OR SELL—Used radio parts, speakers, power trans. coils, 300W 110V ac gen., record players, battery and electric radios. What have you? Blocks Electric Shop, Hartwick, N. Y.

FOR SALE—Bud V.F.O. with 20 meter coils, \$25; New Gon Set 10-11 converter, \$25; Collins MBF, \$25; Butler 10-11 meter converter, \$20. William Terry, 1358 Gundry Ave., Long Beach, Calif.

FOR SALE—15 new Delmar table radio-phonographs at a low price. Also all types of hard to get tubes at 50-5-2 discount. Smith Music Shoppe, 16 E. North St., Danville, Ill.

FOR SALE—Compact, portable home-built audio oscillator, 20 cycles-20kc, twin volume indicators in case with calibrated potentiometers, miscellaneous calibrated potentiometers and load resistors, \$75. D. H. Castle, White Oak Shade, New Canaan, Conn.

FOR SALE—New Star tube tester, \$29.69; complete set of imported music engraving tools, \$148.89; Sweigard Ideal No. 4 photo engraving printing frame, \$39.95. Bluebell Garage, Slatington, Pa.

FOR SALE—Superior model 850 sig. gen., 250kc to 99mc in seven bands, 110V 60 cycles, audio may be used separately, complete with all cables, good condition, \$25 FOB Brooklyn. Martin Prager, 1288 St. Johns Place, Brooklyn 13, N. Y.

WANTED—1940 Studebaker Champion custom-built auto radio. State condition and price. Horace O. Pease, U. S. Veterans Hospital, Box 23, Lyons, N. J.

SALE OR TRADE—Radio Troubleshooters Handbook, 3rd revised edition; Modern Radio Servicing by Ghirardi; Audels New Radiomans Guide; vol. 9 Audels New Electric Library; Radio Amateurs Handbook '46 edition. All in excellent Condition. Want woodworking power tools, radio parts, etc. Frank Edwards, 1511 Sec. St., Corinth, Miss.

FOR SALE—Custom built amplifiers for every purpose, from 4 to 75 watts. Performance guaranteed. Merton Iwerks, Radio Station WBBQ, Forest City, N. C.

FOR SALE—Gene Krupa model Slingerland drums. Toms cymbals, high hat, etc., complete set, silver-blue finish. \$210 cash FOB, or equivalent value in radio equip. J. S. Nichols, 1907 8th St., Marysville, Washington.

FOR SALE—Onan model 10-L generator, 1000 watt, 110V ac, gasoline driven, manual start, used one year, good condition, \$200. Also Knight 7 watt Little Giant PA system, Xtal mike, speaker and 25' cords, excellent condition, \$30. G. F. Williams, Manteo, N. C.

FOR SALE—18" Cineaudograph PM speaker, hi fidelity model SU, 35 watt rating, 3" V.C., new magnet, like new condition, 8 ohm V. C. M. A. Porter, 1709 N. Larrabee St., Chicago 14, Ill.

TRADE OR SELL—Rolliecord reflex camera, Zeiss 4.5 lens, compure shutter and case. Want late model communication rec. Make offer. H. Gursh, 147 Chester St., Brooklyn 12, N. Y.

FOR SALE—Riders' Manuals 1 to 8, 10 and 13, \$12 ea.; 5 Hammerlund Super-Pro receivers, \$125 up; BC 696, \$15 ea.; RCA Marine receiver, 70 to 515kc, mod. AR8507, nearly new, \$150. A. Livingstone, 12-01C Ellis Ave., Fair Lawn, N. J.

FOR SALE—Tech Manual on BC-312-342-344, \$1; brand new Supreme multimeter, 543S-5K o.p.v., \$10. Wagner Radio, 5904 S. Princeton Ave., Chicago, Ill.

SELL OR SWAP—K-8 Presto recorder, shop worn; new S-38 Hallicrafter; new Mark II transceiver; new BC 728-A jeep 6V radios, 2000 to 6000kc; new-used radios, most makes. Ralph's Radio Sales, Demorest, Ga.

FOR SALE—Tubes, new and guaranteed: 50L6, 35Z5, 12SQ7, 12SA7, 12SK7, 35W4, 12AB6, 12AT6, 50B5, 175, 1S5, and many others, 70% off list. Also a few new condensers, 70% off. A. Alexander, 159 Putnam St., New Haven Conn.

SELL OR TRADE—Miscellaneous radio parts, including transformers, chokes, reactors, resistors, mica condensers, meters, 50 good tubes (mostly new and unused), N.R.I. radio and television course and equip., \$75 cash. Want Argoflex Camera or H.O. gauge model railroad equip. John D. Grow, 7712 Westmoreland Ave., Swissvale, Pa.

TRADE—Remington SHA-330 cash register, gives total cash, paid outs and no sales, in good condition. Want Army type 1-222-A sig. gen; type 3CM Micrometer wave meter with wave guide; or 110V 60 cycle ac gas generator. Electronic Maintenance 423 Main St., Palmer, Mass.

FOR SALE—New 1/4 h.p. belt driven, diaphragm air compressor, complete with ac motor, tank, pressure switch, air regulator, gauge and filter, \$55. Also new air tank 10" x 22", \$10. Arnold Larson, 883 - 57 St., Brooklyn, N. Y.

FOR SALE—Condensers: 25 assorted micas, .0001 to .0068, \$1; 5 oil-filled, Aerovox and G.E., .5 mfd., 1000 wv., \$1.35; 5 micas, .007 mfd., 1200 wv., \$1.60. Over one lot 10% discount. Cash orders prepaid. Earl Huff, Norris, Tenn.

WANTED—Television set complete, with or without cabinet. Also tube and set tester, other testing instruments, and radio courses. Joseph Buda, 461 East 114 St., Cleveland 8, Ohio.

SWAP OR SELL—Have Jackson mod. 427A tube tester; Zenith table model 4-V-31 6V rec. Need Heath 5" scope kit, RCA AVT 112 transmitter, BC 455 receiver. Williams Radio Labs., 108 Harrison St., Wapakoneta, O.

FOR SALE—Signal Corps model 1183SC combination V.O.M. meter, tube and capacitor checker and circuit analyzer, complete with adaptors, manual of instructions and latest tube checking chart, perfect condition, \$40. Also code practice oscillator with switch for 4 different tone frequencies, with key and phones, \$5 plus postage. Julius Lerner, 1523 Unionport Rd., Bronx 62, N. Y.

FOR SALE—Supreme model 599A battery and set tester, like new, \$40. M. M. Tyler, Box 164, Beulah, Mich.

WANTED—Tuning meter for Hallicrafters model SX-28 super skyriders communications receiver. Theo. L. Seybold, 610 Eye St., N. W., Washington 1, D. C.

SELL OR TRADE—Latest model BC221-Q freq. meter, in metal case with spare set of tubes, practically new, best offer. Or will trade for television set in operating condition. T. Lyons, 3803 West 64th St., Chicago 29, Ill.

WILL TRADE—Astatic D-104 microphone for a set of McGraw-Hill Radio Engineering Library in good condition. G. F. Meyer, Jr., 439 No. Preston, Louisville 2, Ky.

FOR SALE OR SWAP—Practically new Buick automobile radio, model 980798. Will consider Mopar model 802. Also need Riders' Manuals No. 14. C. T. Fisher, 1385 H St. N. E., Washington 2, D. C.

WANTED—Microscope; astronomical telescope; filters and tripod for 35mm camera; 5-10 gallon rectangular aquarium, and sig. gen. Will trade high speed key, Riders' Manual 15 unbound, books, and Signal Corps manuals. Marty Cademy, 1541F Lafayette Ave., Bronx 59, N. Y.

SELL OR TRADE—Typewriter, good condition, \$50; electric welder, \$12. Will trade for tube tester or gun for home protection. J. Trowbridge, 653 W. 81st St., Chicago 20, Ill.

WANTED—Calibration chart for BC-221 frequency meter. William Bauer, 6300 Dardanella Ave., St. Louis County 20, Mo.

FOR SALE—Radio tubes, approximately 70% off, all types, brand new, guaranteed, write for information. Also press camera, photography library set, etc. for sale, or trade for radio equip. William Muller, Jr., 1463, Franklin St., Hillside, New Jersey.

FOR SALE—Magnetic recorder-reproducer, complete with crystal microphone-speaker, record head, erasure, record and playback amplifier including tubes, voice quality only. Factory new \$29. complete. Paul E. King, 136 W. 77th, New York 24, N. Y.

FOR SALE—Hard to get tubes, new in original cartons: 1SA6, 1SB6, 3B5, 31, 49, 50, 81. William Shulman, 766 Huntington Ave., Boston 15, Mass.

FOR SALE—Closing shop. Will sell brand new Edwards FM Fidetuners which list for \$48.50 at \$22.50 each. Also like new ac-dc sig. tracer which cost \$34.95 for \$20 cash. G. A. Terpay, 7005 Wells Pkwy., College Heights Estates, Md., Hyattsville, Post Office.

FOR SALE—New Presto 300-A re-recording equip., for use with Presto K8 recorders, \$60. D. R. Bailey, Rt. 4, Box 357, Sarasota, Fla.

SELL OR TRADE—Two ac-dc phono motors, with platters. Want BC221 freq. meter, K-20 aerial camera, S.CR625 mine detector. Stamp for list. Gus Denchler, 1510 Monroe St., Omaha 7, Nebraska.

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